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(71) Applicant *(for all designated States except US)*: **NOKIA MOBILE PHONES LIMITED** [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **VESTERGAARD, Peter** [DK/DK]; Gl. Strandvej 92m, DK-3050 Humlebaek (DK). **LINDHOLM, Rune** [FI/FI]; Mahlarinne 8, FIN-24280 Salo (FI).

(74) Agents: **HAWS, Helen** et al.; Nokia IPR Dept., Nokia House, Summit Avenue, Southwood, Farnborough, Hampshire GU14 0NG (GB).

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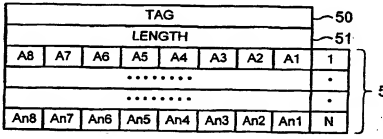
(54) Title: AN INTEGRATED CIRCUIT CARD FOR USE IN A COMMUNICATION TERMINAL



(57) Abstract: An integrated circuit card for use in a communication terminal has a controller, memory means, and a user-interface for communication with a controller of said communication terminal. The integrated circuit card controller controls a plurality of client application programs being selectively activated for the user on said communication terminal. The integrated circuit card comprises non-volatile memory means. The controller of the integrated circuit card allows the user to selectively activate and deactivate applications included in said plurality of applications, and stores information about the status of said selectively activated client application programs in said non-volatile memory means.

WO 00/76239 A1

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An integrated circuit card for use in a communication terminal.

The invention concerns application control in communication terminals having an exchangeable integrated circuit card.

In a multi-application smart card many applications may be active simultaneously. When a user with a multi-application card activates his smart card he may wish to have the possibility to continue the sessions he had active when he last de-activated his card.

An object of the invention is to provide an integrated circuit card for use in a communication terminal being able to re-activate applications that were active when the card was de-activated.

This purpose is obtained by an integrated circuit card for use in a communication terminal where said integrated circuit card has a controller, memory means, and a user-interface for communication with a controller of said communication terminal, said integrated circuit card controller controls a plurality of client application programs being able to be activated selectively by the user on said communication terminal, said integrated circuit card comprises non-volatile memory means included in said memory means; said integrated circuit card controller allows the user to selectively activate and deactivate applications included in said plurality of applications; and said integrated circuit card controller stores information about the status of said selectively activated client application programs in said non-volatile memory means. Hereby the applications of e.g. a phone will be re-activated in the same state as when the card was de-activated. It is important to notice that the card is responsible for storing the information about the re-activation or

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the default configuration of applications. When the card is transferred from a first to a second communication terminal the same applications will be re-activated in the second communication terminal as being de-activated in the first communication terminal.

The invention is also applicable when the user wishes to start the same configurable session (thus called default configuration) each time he activates the communication terminal.

Preferably, when activating the communication terminal the controller of the integrated circuit card reads the information about the status of the selectively activated client application programs and activates the applications included in said plurality of applications accordingly. Hereby the client application programs started up by a phone supporting the inventive concept will have the same status as when the phone was switched off or having the default configuration.

The status of said selectively activated client application programs is stored as a Data Object containing a TAG field identifying the Data Object, a LENGTH field indicating the overall length of the Data Object, and a Value field (Data Element) containing the status information. This Data Object refers to a list of applications supported by the card being stored in an elementary directory file of e.g. a SIM card for GSM or for third generation smart cards.

According to an alternative embodiment a list of applications supported by the card is stored in an elementary directory file and the status information present in the Data Object refers to said list of applications. The number of applications is restricted to the maximum number, and status of said selectively activated client application programs is included in a Data Object containing a TAG field identifying the Data Object; a Length field and a Value

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field (Data Element) containing the status information.

The integrated circuit card controller allows the user to selectively activate and deactivate applications included in said plurality of applications, and the integrated circuit card controller stores information about the status of said selectively activated client application programs in said non-volatile memory means. When the card is transferred from a first to a second communication terminal the same applications will be re-activated in the second communication terminal as being de-activated in the first communication terminal.

According to the preferred embodiment the integrated circuit card may be used as a Subscriber Identity Module (SIM Card) for a portable phone. Basically the integrated circuit card may be provided as a Subscriber Identity Module (SIM) for the GSM specification as described in the specification "Digital cellular telecommunication system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM-ME) interface GSM 11.11 version 7.1.0 Release 1998" from the European Telecommunication Standards Institute (ETSI). Section 11 of the GSM document defines the application protocol for GSM network operation involving the SIM interface with the communication terminal. Section 10 of the GSM document defines the content and the structure of the record stored in the memory of the SIM card.

However the invention is related to Integrated Circuit Cards (ICC) in general and it is expected that the invention will find use in W-CDMA (third generation cellular communication). Integrated circuit cards are standardized in the "International Standard ISO/IEC 7816-5, Identification Cards –Integrated circuit(s) cards with contacts" from the International Electrotechnical

Commission. Section 5 of this document handles the structure of Data Objects stored as records in an ICC memory (SIM card memory).

Smart cards and their way of working is described in chapter 4 of the book Smart Cards written by José Luis Zoreda and José Manuel Otón, Artech House, Inc, 1994.

Fig. 1 schematically illustrates a preferred embodiment of a hand portable phone using an integrated circuit card according to the invention.

Fig. 2 schematically shows the essential parts of a telephone for communication with a cellular network.

Fig. 3 schematically shows the essential parts of an integrated circuit card according to the invention.

Fig. 4 shows the structure of a Data Object according to the preferred embodiment of the invention.

Fig. 5 shows the structure of a Data Object according to a first alternative embodiment of the invention.

Fig. 6 shows the structure of a Data Object according to a second alternative embodiment of the invention.

Fig. 1 shows a preferred embodiment of a phone according to the invention, and it will be seen that the phone, which is generally designated by 1, comprises a user interface having a keypad 2, a display 3, an on/off button 4, a speaker 5, and a microphone 6 (only openings are shown). The phone 1 according to the preferred embodiment is adapted for communication via a

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cellular network, e.g a GSM network. However the invention could have been implemented in any other communication terminal using an integrated card or a smart card.

According to the preferred embodiment the keypad 2 has a first group 7 of keys as alphanumeric keys, two soft keys 8, two call handling keys 9, and a navigation key 10. The present functionality of the soft keys 8 is shown in separate fields in the display 3 just above the keys 8, and the call handling keys 9 are used for establishing a call or a conference call, terminating a call or rejecting an incoming call.

Fig. 2 schematically shows the most important parts of a preferred embodiment of the phone, said parts being essential to the understanding of the invention. The preferred embodiment of the phone of the invention is adapted for use in connection with the GSM 900MHz and GSM 1800 MHz network, but, of course, the invention may also be applied in connection with other phone networks. The processor 18 controls the communication with the network via the transmitter/receiver circuit 19 and an antenna 20 that will be discussed in detail below.

The microphone 6 transforms the user's speech into analog signals, the analog signals formed thereby are A/D converted in an A/D converter (not shown) before the speech is encoded in an audio part 14. The encoded speech signal is transferred to the processor 18, which i.a. supports the GSM terminal software. The processor 18 also forms the interface to the peripheral units of the apparatus, including a RAM memory 17a and a Flash ROM memory 17b, an integrated circuit card 16 (for GSM a SIM card), the display 3 and the keypad 2 (as well as data, power supply, etc.). The audio part 14 speech-decodes the signal, which is transferred from the processor 18 to the earpiece 5 via a D/A converter (not shown).

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The architecture of the integrated circuit card 16 will be discussed in details with reference to fig. 3. Basically a smart card (integrated circuit card 16) includes a Central Processing Unit (CPU) 31, a memory area 33 including memories 34-36, protection circuits 39, a reset circuit 32, a clock 37 and input-output means 38 (including the terminal pads on the card). Smart cards have permanently or non-volatile memory for most applications and memory zones. Volatile Memory may also be included as intermediate memory storage for e.g. direct code execution. All these units may communicate via a common bus 30 and the controller 31 may communicate with the processor 18 in the phone 1 via the input-output means 38 of the integrated circuit card 16.

A volatile memory (RAM, working memory 35) is provided as Dynamic Random Access Memory (DRAM) and/or Static Random Access Memory (SRAM), while a non-volatile Memory is provided as Read Only Memory (ROM including an operating system 34) and Erasable, Programmable Read-Only Memory (EPROM (or EEPROM), user/application memory 36).

The volatile memory (RAM) 35 may serve several purposes, but when the power is switched off the content of the memory will be lost after a while. However the SRAM does not need to be refreshed and therefore the data storage has a very low power consumption. The SRAM is used as a working area, e.g. a RAM stack where intermediate results, e.g. from an encryption or acknowledgement procedure is stored. After finishing a step in the procedure the data is erased.

The user/application memory 36 is the most important memory on the card from the users point of view. The user/application memory 36 is provided as an EPROM or an EEPROM and holds the specific information on every

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application. The information is usually a data set including user data, issuer data, and operations performed by the card. In some cases the user/application memory 36 may also contain executable functions. The user/application memory 36 is protected by the controller 31, which filters the data flow, manages data storage and reading, and runs pre-programmed executable functions.

The micro circuits of the integrated circuit card 16 is almost a complete computer system without keyboard and display. Instead the User Interface is constituted by the terminals (input-output means 38) provided on the integrated circuit card 16. The core of the card's microcircuit is the controller 31 (a microprocessor usually called CPU). The CPU is able to execute an instruction set that ultimately defines the capabilities of the card. Preferably the instruction set is permanently wired into the card 16. Higher level functions are permanently stored in the card memory, indicating to the CPU what to do, when, and how to do it. These functions could be considered as being the operating system of the card 16. The operating system of the card allows the CPU to manage the user/application memory according to external commands the user invokes from the phone interface. The microprocessor (controller 31) of the card 16 always takes care of the memory management (for the memories on the card) and the data security. Any external (from the phone) access to the card memory or functions is performed through the CPU (controller 31). The operating system of the card 16 is also used to define executable functions eventually stored in the user/application memory 36.

It is a general feature in the ISO 7816 standard and related specifications that when a Dedicated File (DF – a file stored on an ICC (Integrated Circuit Card) and containing access conditions and, optionally, other Dedicated Files) or Elementary Files (EF - a file stored on an ICC and containing access conditions and data and no other files) is selected a number of File Control

Information (FCI) bytes can be read. However the invention may work for other EF's as well, i.e the storing of the status parameters is generic.

According to the preferred embodiment of the invention an EF_{DIR} file contains a list of applications as well as an indication about where the applications can be found and some textual description of the application. EF_{DIR} file is an elementary directory file containing a list of applications supported by the card. Detailed descriptions of solutions on 7816 and GSM compliant cards are listed below. However it should be noted that the solutions below are not restricted to cards complying to the two mentioned standards.

According to the invention the user can in a Default Configuration Mode define a set of default applications to activate when the communication terminal is started up.

ISO 7816 compliant cards.

In an ISO 7816 compliant card a Data Object (TLV) is provided in the File Control Information (FCI) bytes containing information about the present status of the applications in the communication terminal according to the invention. When the communication terminal is switched on this information indicates which of the applications that were active when the last session was terminated. Alternatively the communication terminal is switched on in a default configuration. The Data Object (TLV) is shown in fig. 4 has a TAG 50, e.g. having the length of one byte. This TAG 50 identifies the Data Object as being a Data Object that indicates the status of the applications in the communication terminal. The Data Object (TLV) has furthermore a LENGTH field 51 indicating the overall length of the Data Object (TLV). The LENGTH field 51 has the length of e.g. one byte and indicates the number of bytes present in the Data Object (TLV).

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The third part of the Data Object (TLV) is a Value field 52 (Data Element) and this field contains the status information. It is the responsibility of the operating system on the card to ensure that the fields are updated correctly. If the first application stored in the EF_{DIR} file was activated then A1 is set to the binary value "1" otherwise it is set to "0" and so on.

Preferably the number N in fig. 4 of active applications is likely to be restricted to the maximum number of logical channels, that is currently 4, another proposal is listed. This is illustrated in fig. 5.

In this case an index 53, in the EF_{DIR} file, to the applications active during the last session is given in the File Control Information (FCI). The LENGTH field 51 may be omitted if the maximum number is fixed, e.g. is limited to 4 (or if it is later agreed that even though more than 4 can be active 4 is the default value). If an index 53 is not used it shall be initialised to a specific predetermined value (e.g. 0xFF).

GSM 11.11 compliant cards

For GSM 11.11 compliant cards it is proposed to add to the response bytes a number of bytes each containing an index 54 (fig. 6) in the EF_{DIR} file for the applications that were active when the card was last de-activated – this is similar to proposal discussed with reference to fig. 5 except that the TAG field 50 and the LENGTH field 51 has been omitted.

Presently it is foreseen that the relevant number of bytes required is equal to the number of logical channels. Furthermore if an index is not used it shall be initialised to a specific predetermined value (e.g. 0xFF).

According to the invention the Integrated Circuit Card can be in one of the following states. In an automatic mode the applications active (as indicated in the TLV defined above) during the last session are re-activated at start-up and

the appropriate Card Holder Verification (CHV) can be entered (Default configuration mode). The Card Holder Verification information includes access conditions used by the SIM for the verification of the identity of the user.

In manual mode the list of all the applications stored in the card is presented to the user and it is then up to the user to select which applications he wishes to activate.

The same will be valid for third generation (W-CDMA) cellular systems.

According to the preferred embodiment of the invention the controller 31 stores the information about active applications in the user/application memory 36 of the integrated circuit card 16. This means that the phone 1 when switched on starts applications having the same status as when the phone 1 was switched off or in the default configuration. Furthermore the invention ensures that the phone 1 when switched on with a SIM transferred from another phone starts applications having the same status as when the other phone was switched off.

The Integrated Circuit Card may somewhere in the memory include an indication of some preferred applications. The list may be used when the Integrated Circuit Card is in a kind of automatic mode – and this list is somewhat similar to the PLMN preferred list but is extended to contain only non-telecom applications, e.g. banking applications.

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Claims

1. An integrated circuit card for use in a communication terminal, said integrated circuit card has a controller, memory means, and a user-interface for communication with a controller of said communication terminal, said integrated circuit card controller controls a plurality of client application programs being selectively activated for the user on said communication terminal, said integrated circuit card comprises

- non-volatile memory means included in said memory means;
- said integrated circuit card controller allows the user to selectively activate and deactivate applications included in said plurality of applications; and
- said integrated circuit card controller stores information about the status of said selectively activated client application programs in said non-volatile memory means.

2. An integrated circuit card according to claim 1, wherein said integrated circuit card controller when activating the terminal reads the information about the status of said selectively activated client application programs and activates the applications included in said plurality of applications accordingly.

3. An integrated circuit card according to claim 1 or 2, wherein the status of said selectively activated client application programs is included in a Data Object containing:

- a TAG field identifying the Data Object;
- a LENGTH field indicating the overall length of the Data Object; and
- a Value field (Data Element) containing the status information.

4. An integrated circuit card according to claim 3, wherein a list of applications supported by the card is contained in an elementary directory file and the status information present in the Data Object refers to said list of applications.

5. An integrated circuit card according to claim 1 or 2, wherein a list of applications supported by the card is contained in an elementary directory file and the status information present in the Data Object refers to said list of applications and wherein the number of applications is restricted to the maximum number, status of said selectively activated client application programs is included in a Data Object containing a TAG field identifying the Data Object; and a Value field (Data Element) containing the status information.

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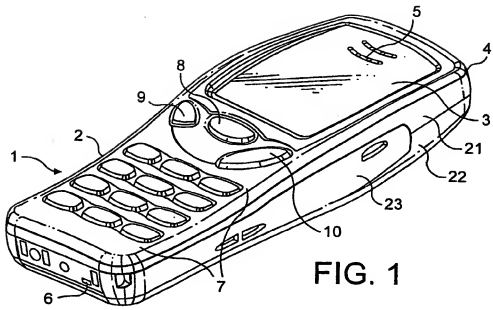

FIG. 1

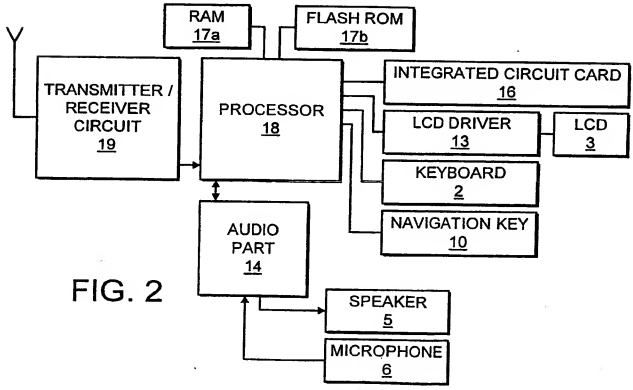

FIG. 2

JOGID: <WO___0076239A1_I_>

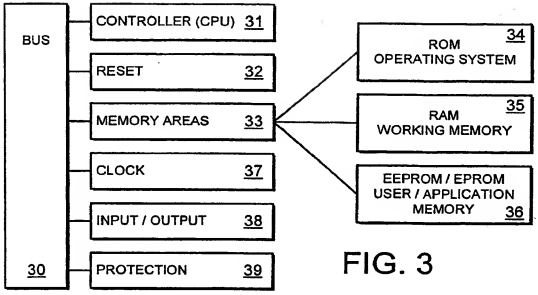

FIG. 3

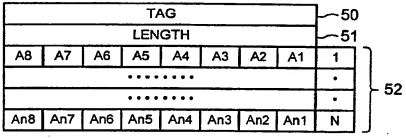

FIG. 4

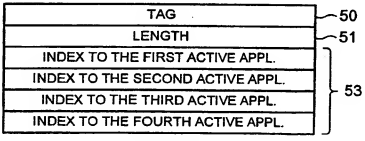

FIG. 5

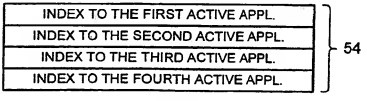

FIG. 6

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INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/IB 00/00823

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/32 H04M1/247

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 748 834 A (GEMPLUS CARD INT) 21 November 1997 (1997-11-21) page 1, line 23 -page 2, line 25 page 6, line 1 -page 8, line 10 page 12, line 5 - line 26 page 18, line 1 - line 24 abstract; figures 1,3B,4,6,10	1-5
X A	US 5 814 798 A (ZANCHO WILLIAM F) 29 September 1998 (1998-09-29) column 2, line 31 -column 4, line 13 column 5, line 61 -column 6, line 62 column 8, line 10 -column 9, line 21 column 11, line 49 -column 12, line 10 abstract; figures 8-10,14-17	1,2,5 3,4

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 October 2000	17/10/2000

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Inter onal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	the whole document	3
X	GUTHERY: "JAVA CARD: Internet Computing on a Smart Card" IEEE INTERNET COMPUTING,US,IEEE SERVICE CENTER, PISCATAWAY, NJ, 1 February 1997 (1997-02-01), pages 57-59, XP002077647 ISSN: 1089-7801 the whole document	1

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Interr nal Application No
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